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THE CHALLENGES OF SIMULATION TRAINING OF THE TROOPS IN THE CONTEXT OF THE EMERGING TECHNOLOGIES

Cristian ȚECU
Joint National Training Center, Cincu, Romania
cristian_tecu@yahoo.com

Sorin PÎNZARIU
"Nicolae Bălcescu" Land Forces Academy, Sibiu, Romania
sorinpinz@yahoo.com

ABSTRACT

Training using different simulation systems has become a necessity for the military organizations over the past decades. As the operational environment is constantly changing and the technologies are evolving, simulation systems have also developed. Depending on the domain and branch the simulation training is used for, there have been serious challenges in adapting the systems to the current technological era. Moreover, the emerging technology had a great impact on the military training using simulation systems and has brought an advantage to this domain. Consequently, individual training, collective training, special skills training using simulation systems have been some of the aspects that have been consistently changed and improved over the past years. Technologies such as virtual reality (VR), augmented reality (AR), artificial intelligence (AI), soldier simulators and the initiative of converging constructive and virtual simulation through cloud technologies are some of the major sciences that have been starting to be developed, tested and used for military training purposes. Nevertheless, technological development and operational changes need to also face the challenges of interoperability of the simulation systems that would eventually need to be connected in the inevitable context of integrated, distributed, joint or multinational events.

KEYWORDS: Virtual Reality, Augmented Reality, Artificial Intelligence, simulation in cloud

1. Introduction

The goal of this paper is to present the emerging technologies that are having an important impact upon the military training through simulation and the challenges brought along. In order to achieve the goal of this paper we used two research methods: observation and literature review.

As the technologies are evolving, the defence structures are embracing these new innovative high-tech sciences and are trying to apply them throughout all their domains.

The battle space has been very dynamic over the past decades, the conventional warfare has slightly been replaced by the hybrid warfare and the demand for approaching new ways of training had increased.

The aspects presented in the paragraphs above, have led to the use of emerging technologies for training the military personnel.

Aligning to the changes and developments in technology is mandatory for

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the military organization. *"We must keep up with the pace of evolving disruptive technology"* stated Admiral Christopher W. Grady during a key note address at the Interservice-Industry Training, Simulation and Education Conference in Orlando, Florida, hosted by the National Training and Simulation Association on the 27th of November 2018. Thus this is the only way forward for the defence sector.

2. Virtual and Augmented Reality

There is well known the fact that for the powerful and well developed countries the military sector has been at the forefront of applying emerging technologies and innovations for the purpose of effective training.

Virtual reality (VR) and augmented reality (AR) have brought a complete transformation for the way military personnel are trained. Even if the first such technologies came out as commercial gaming innovations, soon the military sector of some of the leading countries has started using them as military training tools. These changes have brought training using simulation system to a whole new level.

Virtual technology has existed for over 30 years, its use has become invaluable for the training opportunities of all services of the Army (Mayfield, 2021).

Virtual reality use for the military domain involves simulators of all kind of military equipment and simulation of virtual environments, computer based programs, etc. It is used not only for individual training, but also for collective training events.

As an item of novelty in the virtual reality domain is the human model. The University of Iowa Technology Institute has been working to develop the virtual soldier. Hence, the project called Santos. There is also a female counterpart Sophia. The main features that make Santos *"stand apart from other human models developed so far is a suite of interconnected, real-time, validated, physics-based, predictive capabilities, as well as the foundation it provides for the most comprehensive multi-scale digital human"* (IOWA Technology Institute, 2021). As an emerging technological improvement, this virtual soldier can predict human performance, accelerate acquisitions and reduce injuries.

An important step forward for the technological domain was the augmented reality capability. Therefore the AR is using a real world setting, as opposed to the VR. It transposes data or digital images on top of the real world field. Some of the first uses of the AR technology in the military domain was for the pilots training, tactical augmented reality goggles, AR sand tables and combat vehicles using AR technology.

Using VR and AR technology for military training have brought advantages such as better situational awareness, the reduced costs of training, safer training environment, terrain diversity and customization.

AR technology has not reached maturity yet and requires further research, but there is a start in using it for training purposes within the military sector.

Of course there is a certainty that using these training capabilities is beneficial for training, but there is a cost related challenge for the nations that do not have a budget for this sort of equipment.

3. Artificial Intelligence (AI) use for Training

There have been all sorts of myths regarding the AI, such as the AI will control the humans, so there has been certain reluctance in using it. Nevertheless, there were found pragmatic uses for it in the military domain, such as: pathfinding, navigation, recognition of events and situations, adapt reactions, suggest course of action.

Now there is more a matter of how to use this capability than if to use it.

Using technologies such as AI with training purposes within the army is sort of a

measure to help meet the future training challenges.

In the *"Artificial Intelligence in the US Military Training and Simulation Industry, 2020"* report it was stated that the main goal of AI use within the military is to *"improve the readiness of troops and increase lethality, allowing the military to face non-conventional adversaries"* (Research and Markets, 2020).

The challenge of the AI use in the military is mainly the large amount of data required by the algorithms and the access to large data bases. The researchers in this domain consider that AI systems will become an inseparable element of future armed conflicts (Bistron & Piotrowski, 2021).

The AI is a fantastic tool and the potential military users must be aware that AI may be modelled for the exact purpose it is needed for. Thus in order to improve a series of military capabilities using AI there could be used machine learning techniques for the agents such as image classification and reinforcement learning.

The main challenge related to the aspect presented in this paragraph is the human beings reluctance to use this sort of technology for military purposes.

4. Simulation in Cloud Technology

Military potential has always been an important factor for any powerful state. This factor is mainly conditioned by the troops readiness and capability. Thus, ways of effectively training using the newest technologies is one of most important goals of the international actors.

Simulation in the cloud seems to be one of the latest technologies of interest for the military sector of the main leading nations. There is a growing interest for this type of flexibility in military training that this technology can provide. Being able to have access to training from any remote location, any theatre of operation, or any deployment area, is one of every powerful nation's goal.

There are currently some commercial games using the cloud technology, such as World of tanks and Warframe, but they are only using a limited number of players. Transferring a complex simulation system in the cloud is much harder because of its processing and 3D content needs.

Spatial OS is a cloud platform developed by a British multinational technology company called Improbable Worlds Limited, that, is currently being used by the US and UK military organizations for training purposes.

During the I/ITSEC 2018 in Orlando, Florida, Bohemia Interactive Simulations and Improbable made a simulation demonstration using the SpatialOS cloud platform. The simulation included over 1.5 million entities that were interacting in VBS STE and VBS3 software products, developed by Bohemia Interactive Simulations.

A current project for the well-developed military organizations is to integrate virtual, constructive and gaming training environments into single unified architectures. There have been similar requirements from the important actors in the defence sector.

The United States Army program called the Synthetic Training Environment (STE) is an initiative through which they are trying to revolutionize the entire training basis of their Army. This program comes as a next generation solution for collective training and mission rehearsal based on an unified architecture. In order to accomplish this, the US Army needs the cloud based simulation, a "one world terrain" inserted in the cloud, an unified simulation environment, interoperability between systems and many other capabilities. This initiative aims to enable the military personnel to conduct training and other complex simulation events anywhere, on a virtual representation of the Earth and using different simulation systems.

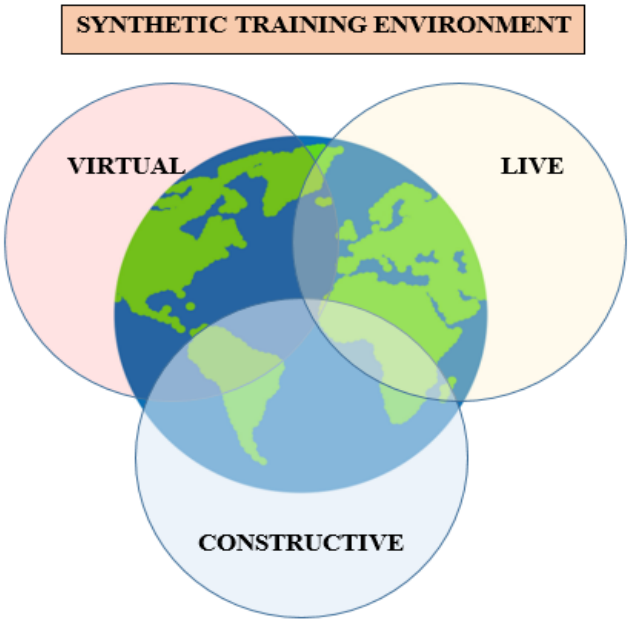

Figure no. 1: *The concept of simulation within synthetic training environment*

United Kingdom has a similar program called "Collective Training Transformation Programme", as well Australia, with the "Land Simulation Core 2.0" program (NATO Modelling & Simulation Group, 2019).

These are long term projects with demanding requirements that are beyond what the commercial companies and government organizations are providing currently.

Having virtual and constructive simulation systems interoperable and used in the cloud, is for sure a great challenge. There will be a lot of resources spent, but due to the emerging and disruptive technologies, some of the steps of the process have already been made.

The bottom line is that the convergence of live, virtual and constructive simulation in cloud technology is possible, even if it requires a large budget and a huge amount of work. It is surely a worthy vision for the future of military simulation training.

5. Conclusions

The military organizations should not fight the emerging and disruptive technologies, they must embrace the change they provide and use them as an advantage. However, not applying and using new technologies would make armies face an enemy who is way more technologically advanced. This is an option that should not be ever taken into account.

For the military, disruptive technologies transform defence capabilities and methods, shifting the force balance and unhinging opponent capabilities (NATO Science & Technology Strategy, 2018).

Using these latest technologies in the process of training the military personnel will be beneficial not only for the velocity of learning, but also for the quality of the practice.

A real challenge for the nations in using these new technological instruments is the related high cost. Taken into consideration that some of the technologies presented are still requiring testing and development, thus it means even more funds.

When digitalizing an entire army, when using the newest technologies, there is mandatory to take new security and cyber security measures. These actions imply great and safe planning of the entire architecture, continuous work along with high related costs.

From a different perspective, another challenge in using emerging technologies in training military personnel is the reluctance of the soldiers, since the fast development of these sciences and the incapacity of keeping up the pace with every new invention. As well as this aspect it could also be mentioned the cultural detail. On the other hand, these instruments may be used for the new generation of trainees that readily accept new training paradigms.

One of the most important challenge that the military organizations are experiencing is represented by the interoperability aspect.

Interoperability has always been a persistent issue. Simulation systems are created by different producers, nations have their own acquisitions policy, thus joint and coalition training, mission rehearsals and other kind of federated training events and exercises have been obstructed by incompatibility and interoperability problems.

Last but not least, the technology development will always be moving fast. Training requirements of the military organizations in matter of technological instruments must meet the necessities. This is the only way the innovative technology can really make a change in the capability of proficient training and the readiness of troops.

REFERENCES

Bistron, M., & Piotrowski, Z. (2021). Artificial Intelligence Applications in Military Systems and Their Influence on Sense of Security of Citizens. *Electronics. Vol. 10, Issue 7*, 871.

IOWA Technology Institute. (2021). *SANTOS: The Virtual Human*. Available at: https://iti.uiowa.edu/santos-virtual-human, accessed on 27 August 2021.

Mayfield, M. (2021). National Defence Magazine. *Virtual, Augmented Reality Tech Transforming Training*. Available at: https://www.nationaldefensemagazine.org/articles/2021/2/17/virtual-augmented-reality-tech-transforming-training, accessed on 24 August 2021.

NATO Modelling & Simulation Group. (2019). *16th Workshop on Commercial Technologies and Games for Use in NATO and Nations*. Available at: https://www.sto.nato.int/publications/STO%20Meeting%20Proceedings/STO-MP-MSG-175/$MP-MSG-175-A.pdf, accessed on 26 August 2021.

NATO Science & Technology Strategy. (2018).

Research and Markets. (2020). *Artificial Intelligence in the US Military Training and Simulations. Research Report*. Available at: https://www.prnewswire.com/news-releases/artificial-intelligence-in-the-us-military-training-and-simulations-2020-research-report-featuring-google-ibm--microsoft-301197438.html, accessed on 25 August 2021.